ENVIRONMENTAL RESEARCH INSTITUTE OF MICHIGAN
FORMERLY WILLOW RUN LABORATORIES, THE UNIVERSITY OF MICHIGAN
P. O. BOX 618 • ANN ARBOR • MICHIGAN • 48107
PHONE (313) 483-0500

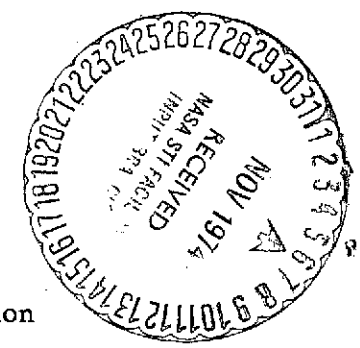
101900-40-L
14 October 1974

Developing Processing Techniques for Skylab Data
Monthly Progress Report September 1974

EREP Investigation 456 M
NASA Contract NAS9-13280

Prepared by

Richard F. Nalepka - Principal Investigator
William A. Malila - Co-Principal Investigator



NASA Technical Monitor

Mr. Larry B. York/TF6
National Aeronautics and Space Administration
Johnson Space Center
Principal Investigator Management Office
Houston, Texas 77058

Developing Processing Techniques for Skylab Data
Monthly Progress Report, September 1974

The following report serves as the nineteenth monthly progress report for EREP Investigation 456 M which is entitled "Developing Processing Techniques for Skylab Data". The financial report for this contract (NAS9-13280) is being submitted under seperate cover.

The purpose of this investigation is to test information extraction techniques for SKYLAB S-192 data and compare with results obtained in applying these techniques to ERTS and aircraft scanner data.

During September we continued the analysis of the S-192 data set provided through ERIM's EOS Systems Study.

Previous to this month, we had located coordinates (line and pixel numbers) for 18 training areas for four different object classes: corn, woods, senescent vegetation, and bare soil. Training set selection was limited to field center points in large fields located in one area of the scene. In all, 107 corn points, 77 bare soil points, 36 senescent vegetation points and 49 woods pixels were identified.

One spectral signature (mean signals and associated covariance matrices) was calculated for each object class using all the data points from the training areas of that object class. Statistics were taken for just 13 channels of data: S-192 tape channels 22, 18, 2, 4, 6, 8, 10, 19, 20, 17, 12, 14, 16 (listed in order of increasing wavelength covering the entire S-192 waveband).

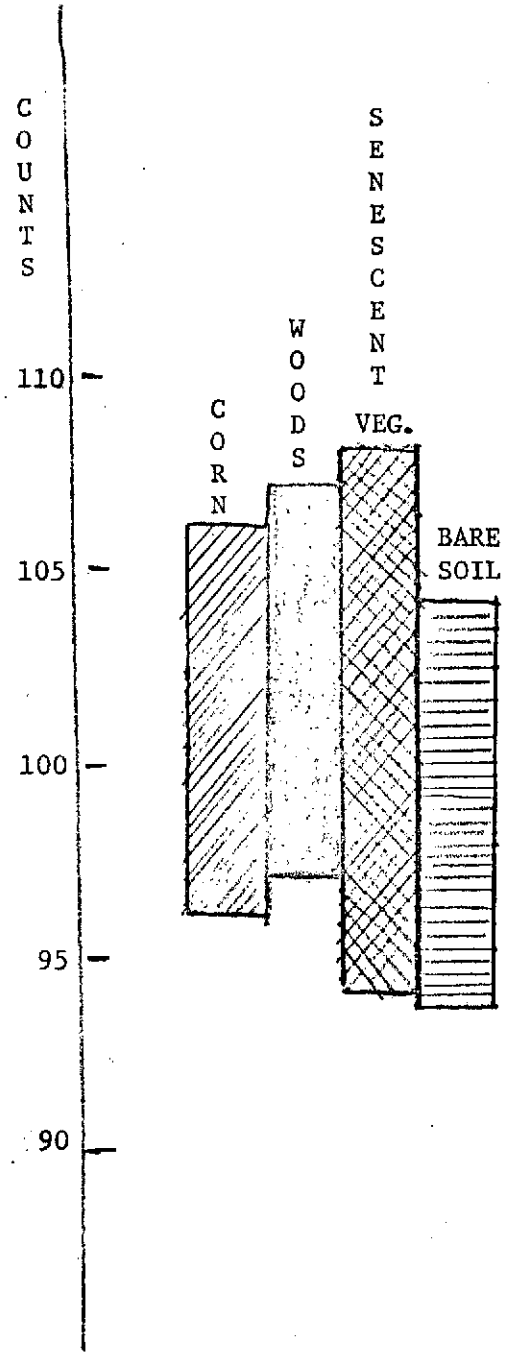
In analyzing the signatures for separability, it was noticed that the channels fell into two groupings: A) where nothing was separable; and B) where the "green" classes (woods and corn) were discernable from "non-green" (senescent vegetation and bare soil). In no case was it possible to discern bare soil from senescent vegetation, or corn from trees.

In Figure 1 we have illustrated these two cases by graphing the mean signal $\pm$ one standard deviation for each of the object classes for selected channels. In Figure 1a we show a channel from group A; Figure 1b shows a channel from group B.

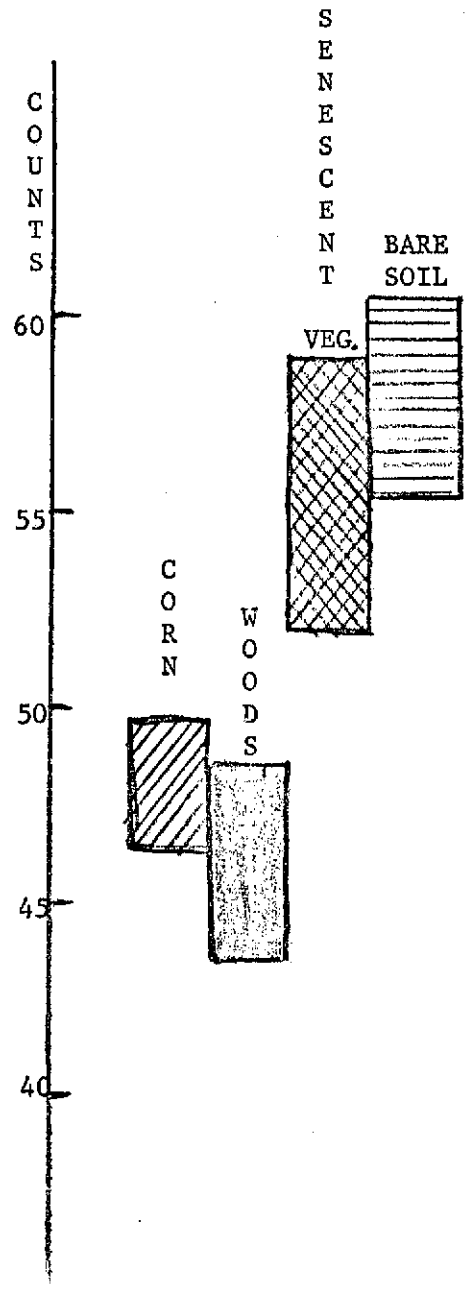
GROUP	S-192 TAPE CHANNELS	SEPARABILITY
A	22, 1, 19, 20, 17, 16	None
B	18, 2, 4, 6, 8, 20, 12, 14	(corn, woods)(soil, senescent vegetation)

TABLE 1

FIGURE 1. EXAMPLES OF SIGNATURE MEANS + 1 STANDARD DEVIATION
SKYLAB S-192 DATA, FOUR OBJECT CLASSES TWO CHANNELS



CHANNEL 17
GROUP A



CHANNEL 4
GROUP B

It has been conjectured that part of the reason for the inseparability of the object classes is the very limited dynamic range in the data (or alternatively the amount of compression applied to the data during the calibration and reformatting of the data). It is interesting to note from Table 1 that the channels have clustered along "hardware" lines - group 1 being all low sample rate channels and group B (with the exception of channel 18) are all high sample rate channels. This seems to indicate that we are dealing, in part, with a processing induced problem.

It should be remembered that the data tapes we have been analyzing were interim products and do not represent the quality of the final EREP system output. Since changes in the calibration and reformatting procedure have been made, it is anticipated that problems due to the limited dynamic range of this present data product will not exist in the final EREP data that we will receive for use in this contract.

In addition to the processing of the EOS study data, this month we began work on other aspects of this contract, namely preparing and organizing for the processing of ERTS and aircraft scanner data sets, as called for in the contract statement of work.

In regards to the available ERTS data, a check with the Sioux Falls EROS facility showed that there were three ERTS passes over the Michigan Test Site during a time in the 1973 growing season comparable to the Skylab Data we will be processing 14 July, 1 August, and 19 August. It was found that for both the 14 July and 1 August data there was 100% cloud cover for the ERTS frame. The 19 August frame had only 50% cloud cover, but examination of the ERTS imagery showed that the clouds covered 100% of the test site. Thus, it appears that no comparable ERTS data over the Michigan test site is available for processing.

We fared better in the acquisition of aircraft scanner data. The ERIM C-46, equipped with the ERIM M-7 multispectral scanner, made repeated passes over an intensive study area of the Michigan Test Site, the same morning as the Skylab overpass, (see Mission Report, NASA Project S456).

We have spent the past month reviewing scanner imagery, ground information, photography, etc., to select which of the data collected we will want to process. In addition, we have begun to define processing goals and techniques for the data and to plan the data processing scheme accordingly. It is anticipated that these preparations will be concluded during the coming month (October) and that we will begin digitizing and processing the selected aircraft acquired data.

Submitted by: Richard F. Nalepka
Richard F. Nalepka
Principal Investigator

Approved by: Jon D. Erickson
Jon D. Erickson
Head, Information Systems
and Analysis Department

Approved by: Paul R. Lin for
Richard R. Legault,
Director, Infrared and
Optics Division

1p